CLAIMS

What is Claimed is:

1.   A resonant type transducer comprising:

a vibrator body comprising piezoelectric material having a first acoustic impedance associated with a resonant frequency;

a matching layer coupled to said vibrator body and having a second acoustic impedance;

said matching layer acoustically matching said piezoelectric vibrator to a radiation medium contacting said matching layer, said radiation medium having a third acoustic impedance,

wherein said second acoustic impedance associated with said matching layer is less than said third acoustic impedance associated with said radiation medium.

2.   The transducer according to claim 1, wherein said transducer is an ultrasonic transducer operative in a continuous wave (CW) mode.

3.   The transducer according to claim 1, wherein the vibrator body has a thickness of approximately one half the wavelength of the resonance frequency.

4.	The transducer according to claim 1, wherein the radiation medium is a liquid or a solid.

5.	The transducer according to claim 1, wherein the radiation medium is water.

6.	The transducer according to claim 1, wherein the vibrator body comprises a piezoelectric or electrostrictive ceramic.

7.	The transducer according to claim 1, wherein the vibrator body comprises a piezoelectric or electrostrictive crystal structure.

8.	The transducer according to claim 1, wherein the vibrator body comprises a piezoelectric or electrostrictive polymer film.

9.	The transducer according to claim 1, wherein the acoustic impedance of the vibrator body at resonance is less than the acoustic impedance of the vibrator body at non-resonant frequencies.

10.	The transducer according to claim 1, wherein the matching layer

comprises a material selected from the group consisting of: polyurethane, polybutadiene and polychloroprene material.

11. The transducer according to claim 1, wherein the matching layer comprises a rubber material.

12. The transducer according to claim 1, wherein the matching layer comprises a polymer material having bubble inclusions.

13. The transducer according to claim 1, further comprising a pair of electrodes, each respectively coupled at a corresponding surface of said vibrator body for applying an electromotive force to said body to excite acoustic signals in said piezoelectric or electrostrictive vibrator body.

14. The transducer according to claim 1, wherein the matching layer contacts said vibrator body at a first surface of said body, and wherein a metal reflective layer is disposed at a second surface of said body opposite said first surface.

15. The transducer according to claim 1, wherein the vibrator body comprises a first polymer material layer bonded to a second layer of polymer

material.

16. The transducer according to claim 15, wherein the first polymer material

    layer comprises PVDF or its copolymer material.

17. The transducer according to claim 16, wherein the second polymer

    material layer comprises a polyester material.

20. A resonant type transducer providing a narrowband, high output or high

sensitivity signal to a radiation medium, said resonant transducer comprising:

    a vibrator body comprising piezoelectric or electrostrictive material having

a first acoustic impedance associated with a resonant frequency; and

    a matching layer for acoustically matching said vibrator body at resonance

to said radiation medium, said matching layer comprising:

    a first layer of material of thickness t1 and acoustic impedance Z1

    and having an

inner surface coupled to a front surface of said vibrator body; and

    a second layer of material of thickness t2 and acoustic impedance

Z2 and having an outer surface coupled to said radiation medium, wherein

the acoustic impedance Z2 is greater than the first acoustic impedance Z1

so as to provide a combined impedance of the matching layer at the front

surface of the vibrator body which is less than the acoustic impedance of

the radiation medium.

21.   The resonant transducer according to claim 20, wherein said thickness t2 is less than one

quarter of the wavelength of the resonant frequency.

22.   The resonant transducer according to claim 20, wherein said thickness t1 is

approximately one eighth to three quarters of the wavelength of the resonant

frequency.

23.   The resonant transducer according to claim 20, wherein second layer

acoustic impedance Z2 is greater than that of said radiation medium.

24.   The resonant transducer according to claim 20, wherein the radiation

medium is water.

25.   The resonant transducer according to claim 20, wherein:

said first layer comprises a material selected from the group

consisting of: polyurethane, polybutadiene, polyisoprene,

polychloroprene, silicon rubber, and soft polyethylene; and,

said second layer comprises a material selected from the group consisting of: mylar, polyester, polystylene, polyimid, polyethersulfer, metal and glass.

26.   A method of forming a resonance transducer, said method comprising:

providing a piezoelectric body having a first acoustic impedance indicative of material characteristics of said piezoelectric body;

providing a propagation medium having a second acoustic impedance; and coupling a matching layer between said piezoelectric body and said propagation medium, wherein said piezoelectric body vibrating at the resonance frequency has a resonance impedance less than said second acoustic impedance associated with said propagation medium, and wherein said matching layer has a third acoustic impedance less than said second acoustic impedance associated with said propagation medium for providing a high output or high sensitivity signal to said medium when operated at the resonance frequency.

27.   The method according to claim 26, wherein the step of coupling a matching layer between said piezoelectric body and said propagation medium comprises providing a first layer of material of thickness t1 and acoustic impedance Z1 and having an inner surface coupled to a front surface of said vibrator body and a second layer of material of thickness t2 and acoustic

impedance Z2 and having an outer surface coupled to said radiation medium,

wherein the acoustic impedance Z2 is greater than the acoustic impedance Z1 so

as to provide a combined impedance of the matching layer at the front surface of

the piezoelectric body which is less than the acoustic impedance of the radiation

medium.